R05

{In Archive} FINAL Supply and Cost Presentations

Sara McGurk to: Sue Slotnick, Sheila Canavan, Maria Doa, Lynn Vendinello, Thomas Groeneveld 09/19/2007 09:39 AM

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Several versions have been floating around, so just to close the loop...here are the FINAL supply and cost presentations electronically.

Supply Presentation FINAL.ppt Private Storage Costs Presentation FINAL.ppt

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Updated Supply Data and Sources of U.S. Mercury

September 20, 2007

Meeting of Commodity-Grade Mercury Stakeholder Panel

Outline of Presentation

- Purpose: To provide updated information about the U.S. supply of commodity mercury
  - Developed with a sub-panel of experts from the Stakeholder Panel

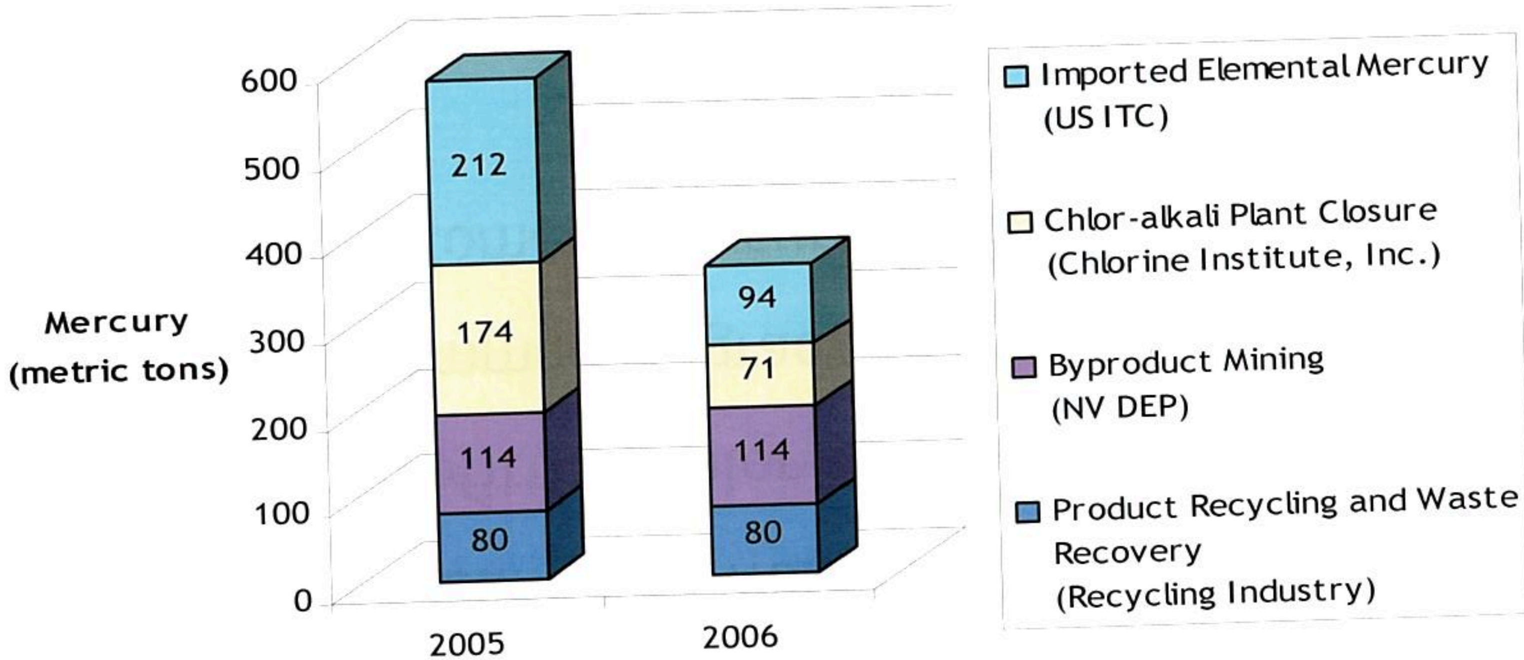
- Outline:
  - Current U.S. supplies of elemental mercury
    - Domestic supply sources
    - Imports
  - Reservoirs of elemental mercury
  - Future trends

Sources of Commodity Mercury in U.S.

U.S. domestic supply sources:

- By-product from gold mining
- Product recycling and waste recovery
- Closing/retrofitting chlor-alkali plants
- Import of commodity-grade mercury
- Import of calomel (mercury chloride)

Estimated Quantities of Commodity-Grade Mercury in the U.S. in 2005 and 2006



Totals: 580 359

U.S. Domestic Supply Source: Byproduct Mining

- Total Annual Supply: ~114 metric tons of commodity-grade mercury in 2006
- Sources: Mercury is captured in air pollution control processes at Nevada gold mines
- Trend: Quantity will likely increase modestly, given the current gold market and likelihood for improved capture technology
  - Quantity dependent upon mine life and industry expansion
- Regulatory Setting: Mercury captured through voluntary air emissions control devices
  - Voluntary air emissions reduction soon to be mandated by State of Nevada

U.S. Domestic Supply Source: Chlor-alkali Plants

- Recent Supply: 174 metric tons in 2005 and 71 metric tons in 2006, 408 metric tons in 2007
- Sources: Elemental mercury released to market upon closure of plants or transition to mercury-free technology.
- Remaining Supply:
  - ~1900 metric tons in the 7 plants still operating
  - ~650 metric tons expected to be released to market from 3 plants closing in 2008
  - Fourth plant will likely close by 2009, likely leaving less than 1,000 metric tons in remaining 4 chlor-alkali plants

U.S. Domestic Supply Source: Mercury Recovered from Products, Waste, and Contaminated Soil

- Total Annual Supply: Anecdotal evidence indicates that from 50 to 80 and up to 100-200 metric tons were recovered in 2006
- Sources: Retorting of end-of-life products, off-spec products, hazardous industrial waste, and contaminated soil from cleanup sites
- Trend: Quantity is assumed to remain the same in the short term (e.g. next decade), and then decline as mercury content of products decreases and waste streams get smaller.

Additional U.S. Reservoirs of Mercury With Limited Levels of Recovery

- ~2000 tons of mercury contained in dental amalgam and products; unknown amount in contaminated soil
- Most is currently landfilled or otherwise released
- Small percentages of the mercury is recovered, e.g. auto switches and fluorescent lamps
- Unknown percentages may be recovered in the future

U.S. Imports and Exports
(Data from U.S. ITC, Metric Tons)

Year	Mercury Equivalents of Calomel Imports	Imports of Elemental Mercury	Total Imports	Total Exports	Net Exports
2002	27	210	237	324	87
2003	11	46	56	287	231
2004	207	92	299	279	-21
2005	328	212	540	319	-221
2006	58	94	152	390	238
Average	**126**	**131**	**257**	**320**	**63**

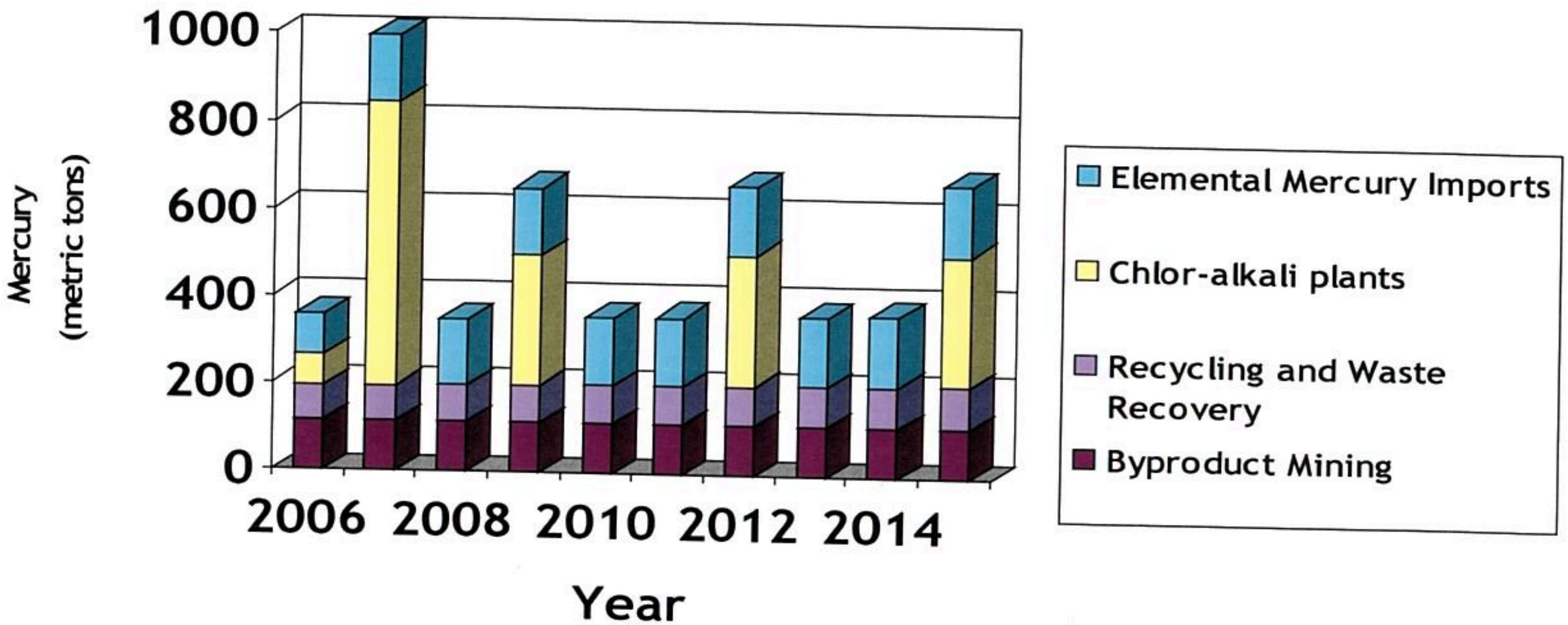
Source: U.S. International Trade Commission U.S. Total Exports and U.S. Imports for Consumption; HTS Codes 2805400000 and 2827392000

- Nearly all calomel imports since 2004 have been from Chile; we assume calomel is 50 percent mercury by weight (can vary from 30 to 80 percent based on weight of water)
- Reported imports of elemental mercury in 2006 were predominantly from Russia (51 metric tons), Peru (22 metric tons), Germany (14 metric tons), and Canada (eight metric tons) whereas 2005 imports were predominantly from Peru (128 metric tons), Chile (31 metric tons), Israel (29 metric tons), Canada (13 metric tons), and Germany (11 metric tons)
- Exports of elemental mercury may reflect mercury recovered from calomel; U.S. ITC data report no exports of mercury compounds (including calomel) in recent years.

Expected Future Trends

- **U.S. domestic supply: ~195 metric tons per year + releases from chlor-alkali plants**
  - Secondary recovery growing slowly, but will ultimately be limited by size of reservoir
  - May decline with demand (with or without a time lag), and with closure of all mercury cell chlor-alkali plants
- **Imports for processing: ~257 metric tons per year**
  - Expected to continue as long as global demand continues; generally re-exported
  - Actual imports will reflect global market conditions and trade policies
- **Reservoirs potentially recoverable:**
  - Uncertain - driven by recovery efforts
  - Reservoirs growing at rate consistent with import of products and manufacturing of products for domestic uses, minus any mercury recovered via recycling, chlor-alkali closures
  - Significant portion of product, amalgam reservoirs is not economically recoverable; unclear whether technological, state regulatory changes will affect this

Summary of U.S. Mercury Supplies



- Releases from chlor-alkali plants are "lumpy."
  - 2006 data reflects the scheduled closure of two chlor-alkali plants
  - We assume a plant releases approximately 300 metric tons every three years after 2009
- Recycling of products and waste may also be "lumpy"-- we assume a slight increase over time in recycling and waste recovery rates.
- We assume continuing trends in imports based on a linear extrapolation of historical data from US ITC from 1989 through 2006

Private Sector Storage and Costs of Private Sector Storage

Presentation by:

Tim Lehman on behalf of Stakeholder Storage Cost Subgroup

U.S. Environmental Protection Agency

September 20, 2007

Presentation Purpose-

Purpose: Estimate the costs of storing mercury by private sector

- Using input from a sub-group of experts from the Stakeholder Panel. Group included David Lennett, Edward Balistreri, Bruce Lawrence, Brad Buscher, Dennis Lynch, William Fortune, and Joe Pollara
- Estimated costs for two scenarios:
  1. Private Storage, Rental Facility
  2. Private Storage, New Constructed Facility

  Method:
  1. Estimated unit costs for mercury storage in each scenario
  2. Calculated total costs

Methodological Assumptions

ASSUMPTION	EXPLANATION	IMPORTANT ELEMENTS AFFECTING COSTS
• Where possible, unit costs are based on existing practice of mercury recyclers & retorters, as well as other relevant secondary sources.	• Based on existing industry practice, storage uses non-flammable materials and densely-packed containers. • Rental costs and construction costs are based on existing storage facilities.	• Fire suppression costs are not included. • 413 pounds of mercury stored per square foot.(3 tons per 16 sq ft pallet) • Mercury is stored in one-metric-ton containers. • Where industry data are lacking, unit costs refer to costs of Defense National Stockpile Center's (DNSC) mercury storage at Hawthorne.

Notes: Secondary sources include Hawthorne's mercury storage costs, typical costs for industrial land in rural Nevada, and costs of mercury detection equipment. The ratio of 413 pounds of mercury stored per square foot is based on Bethlehem Apparatus's practice of storing three metric tons of mercury on each 16-square-foot pallet. Total storage space needed is calculated by taking the total pounds of mercury to be stored, dividing it by 413, and multiplying it by 1.25 to provide clearance space between pallets for inspections. For unit costs based on Hawthorne's data, we take the total storage costs at Hawthorne Army Depot and divide them by the appropriate unit to obtain our estimated unit costs.

Facility Assumptions

ASSUMPTION	EXPLANATION	IMPORTANT ELEMENTS AFFECTING COSTS
• Each building at a storage facility is assumed to be 20,000 square feet, with 25% of total space left open for clearance.	• Based on the size of warehouses at Bethlehem Apparatus's existing storage facility.	• With 4,000 square feet left open for clearance, each building has 16,000 square feet available for mercury storage, enough to store 3,000 metric tons. (16,000 sq. ft. x 413 lbs/sq.ft/2,204 lbs.) • Dividing the total quantity of mercury stored (in tons) by 3,000 yields the number of buildings needed at a storage facility, which affects all building-specific unit costs.
• Locations used as examples for storage facilities are Tennessee and Nevada	• Relate potential transportation costs to existing storage facilities in Oak Ridge, TN or Hawthorne, NV. • Are not intended to represent actual future storage facility locations	• Transportation unit costs are calculated by taking a weighted-average distance from mercury retorters to either NV or TN and multiplying it by an estimated cost per mile per pound.

Notes: For new facility construction, the total land area needing to be purchased is assumed to be equal to the storage area required for storage, plus a 300-foot buffer on each side of the facility added for security.

Regulatory/Insurance Assumptions

ASSUMPTION	EXPLANATION	IMPORTANT ELEMENTS AFFECTING COSTS
• Some planning/permitting costs will be required in lieu of an Environmental Impact Statement (EIS).	• Although a private storer would not be required to produce an EIS, a combination of federal, state, and/or local planning or permitting costs would be imposed.	• Storage costs include $250,000 in planning/permitting costs once every ten years.
• RCRA Subtitle C Part B Permits (or equivalent state permits) will be required every ten years. For purpose of this analysis we are treating mercury as a hazardous waste	• Federal and state requirements for mercury storage will be consistent with RCRA B permitting requirements for Treatment, Storage, and/or Disposal facilities.	• Storage costs include $150,000 in RCRA B permitting costs once every ten years.
• Environmental Damage Liability Insurance will be required.	• Based on EPA Unit Cost Compendium's standard for hazardous waste combustors, assuming a minimum coverage of $4 million per occurrence and $8 million total.	• Premiums of $150,000 are included in annual storage costs.

Notes: Estimates for planning/permitting costs were provided by Joe Pollara of Newmont Mining (using costs of Corrective Action Plan and Bureau of Land Management permits as a reasonable approximation of possible planning costs). Estimates for RCRA B permit costs were provided by Bruce Lawrence of Bethlehem Apparatus. Estimates for environmental damage liability insurance are based on requirements for hazardous waste combustion sites, as reported in EPA's Unit Cost Compendium. Total assured costs for financial assurance depend on the quantity of mercury stored and are based on three closure scenarios:.

Financial Assurance Assumptions

ASSUMPTION	EXPLANATION	IMPORTANT ELEMENTS AFFECTING COSTS
• Trust Fund will be the vehicle used for RCRA Financial Assurance, with a ten-year pay-in period.	• Mercury storage is perpetual. • Trust Fund is the most conservative Financial Assurance Vehicle.	• Approximately 1/10th of total closure costs will be included in the annual storage costs for both storage scenarios for the first ten years of storage.
• Trust Fund costs depend on the quantity of mercury stored and are based on three closure scenarios: low-cost, mid-cost, and high-cost.	• The current operator goes bankrupt and a new operator takes over the storage facility. This is the low-cost estimate. • The existing facility is forced to close, and all stored mercury is relocated to a new, nearby storage facility. This is the mid-cost estimate. • The existing facility is forced to close, and all stored mercury must be stabilized and disposed of. This is the high-cost estimate.	• Closure costs are the net present value (NPV) of 40 years of total annual costs (minus financial assurance) of storing all mercury currently stored at the facility. • Closure costs are the NPV of 40 years of storage, including one-time costs of building or renting a new facility and transporting the mercury to a new site, as well as annual costs (minus financial assurance) of storing the mercury currently stored at the facility. • Closure costs are the total tonnage of stored mercury multiplied by stabilization and disposal costs ($10,000 per ton)- assumes future technology allows this.

Notes: Estimated stabilization and disposal costs come from conversations with Bruce Lawrence, August 15, 2007. Closure costs depend on the total quantity of mercury stored at the time of closure. Although closure could occur at any time during the 40-year timeframe of analysis, as a conservative estimate, closure costs assume that the full 40 years' worth of mercury is stored at the time that closure takes place.

General Assumptions

ASSUMPTION	EXPLANATION	IMPORTANT ELEMENTS AFFECTING COSTS
• The time frame of the analysis is 40 years.	• Based on DNSC's Mercury Management EIS projection of storage costs.	• Estimates of total costs sum one-time costs with annual costs over 40 years.
• Mercury is added annually as generated, identified as excess, or otherwise targeted for storage.	• Storage is modeled on an annual stream, not on an existing stockpile	• Costs associated with preparing, packing, inspecting, and transporting mercury are categorized as annual costs.
• Mercury containers will be inspected and replaced in year 40 of the analysis.	• Assumption from DNSC's MMEIS. • At year 40, leaked containers are disposed of, and mercury is re-packed in new containers.	• Inspection and replacement of containers is listed as a one-time cost in year 40.
• Transportation of mercury is assumed to come from existing retorters and recyclers according to a fixed annual distribution.	• The assumed distribution of mercury among the sources is based on previous market information.	• Distribution is used to create the weighted average distance to the storage facility used to calculate transportation unit costs.

Notes: Though mercury is added as an annual stream, the facility that is built or rented in year one of the analysis is sized according to the total storage needs over the 40-year period. The distribution of mercury sources for estimating transportation costs is based on an approximate market share estimate for the largest three recyclers provided by an industry representative in year 2002. This distribution is used to create an initial placeholder for transportation unit costs to different locations; actual costs will depend on the location chosen for a storage facility and the policy context driving storage decisions.

Unit Costs: One-Time

	UNIT	UNIT COST		SOURCE
		RENT	BUILD	
Planning				
RCRA B Permit (every 10 years)	facility	$150,000	$150,000	1
Planning Permit (every 10 years)	facility	$250,000	$250,000	2
Building Preparation				
Building Design (retrofit & new building)	building	$48,214	$48,214	3, Hawthorne
Construction (retrofit & new building)	square foot	$23	$59 - $83	3, Hawthorne, 5
Land Purchase	square foot	N/A	$3 - $4	4
Material Inspection				
Year 40 Inspection, Disposal, & Replacement	pound	$0.0098	$0.0098	6, Appendix D
Regulatory Compliance				
Financial Assurance				
Trust Fund Initial Payment	pound	$0.0579 - $0.4944	$0.0307 - $0.4944	7

Sources:

1. Bruce Lawrence, Bethlehem Apparatus, August 2007
2. Joe Pollara, Newmont Mining, September 2007
3. DNSC Cost Comparison Matrix, 2007
4. Typical land costs for industrial use in rural Nevada, http://www.nbj.com/issue/0707/2/1634
5. National Association of Industrial and Office Properties, 2003
6. DNSC Mercury Management Environmental Impact Statement, 2003
7. USEPA OSW EMRAD Unit Cost Compendium, 2000

Notes: All costs are adjusted to 2006 dollars. Numbers shaded in blue represent significant cost differences between the two scenarios. Costs for Planning Permits are based on costs of a Corrective Action Plan (CAP) Permit or a Bureau of Land Management (BLM) permit. Trust Fund annual payments are calculated using a formula that incorporates total closure costs, a 10-year pay-in period, a 4% trust fund rate of return, and a 20% marginal tax rate. Closure costs are based on calculations in DNSC's MMEIS that assume 0.74% of mercury flasks need replacement after 40 years at a cost of $99.79 per flask.

Unit Costs: Annual

	UNIT	UNIT COST		SOURCE
		RENT	BUILD	
Mercury Preparation				
Labor & Materials (Flasks, Overpacks)	pound	$0.7409	$0.7409	1, Appendix D
Material Handling	pound	$0.1653	$0.1653	2, Hawthorne
Transportation				
Cost to Oak Ridge, TN	pound	$0.1397	$0.1397	cost per ton per mile from 3
Cost to Hawthorne, NV	pound	$0.4548	$0.4548	
Operations & Maintenance				
Rent	square foot	$6.00 - $9.00	N/A	4
Maintenance	square foot	$0.54 - $2.63	$0.54 - $2.63	2, All Sites
Security	facility	$164,362	$164,362	5
Insurance				
Environmental Damage Liability	facility	$150,000	$150,000	5
Standard Liability	facility	$100,000 - $200,000	$100,000 - $200,000	6
Regulatory Compliance				
Staff Training	facility	$158 - $685	$158 - $685	5
Inspections				
Labor	building	$158 - $685	$158 - $685	5
Equipment	facility	$1,608	$1,608	7
Financial Assurance				
Trust Fund Payments (first ten years only)	pound	$0.0579 - $0.4944	$0.0307 - $0.4944	formula from 5

Sources:

1. DNSC Mercury Management Environmental Impact Statement, 2003
2. DNSC Cost Comparison Matrix, 2007
3. EMRAD Chat Analysis, 2006
4. Bruce Lawrence, Bethlehem Apparatus, July 2007
5. USEPA OSW EMRAD Unit Cost Compendium, 2000
6. Joe Pollara, Newmont Mining, September 2007
7. Cost of Mercury Tracker 3000, Mercury Instruments USA

Notes: All costs are adjusted to 2006 dollars. Numbers shaded in blue represent significant cost differences between the two scenarios. Costs for staff training for regulatory compliance are assumed to be comparable to labor costs for inspections. Trust Fund annual payments are calculated using a formula that incorporates total closure costs, a 10-year pay-in period, a 4% trust fund rate of return, and a 20% marginal tax rate.

Limitations

- Actual design and construction costs would vary from site to site.
- Security costs in this analysis represent a lower bound cost scenario (i.e., two security guards providing 24/7 surveillance) that assumes that environmental risk is the principal security concern.
    - If Mercury is treated as a national security risk (i.e., theft of mercury or attacks on the facility are a concern), more advanced measures will be required and should be added to the current cost estimate. These include:
        - A quarter-mile perimeter around the storage facility
        - Constant monitoring (inside and at perimeter)
        - Terrorism insurance

Total Cost Estimates

- "Per Pound" cost estimates depend on key assumptions:
  - Total quantity of mercury stored
    - Unit costs are per facility, building, square foot, and pound, so per-pound estimates vary by total quantity of mercury stored.
    - Financial assurance trust fund payments are determined by closure costs, which depend on the total quantity of mercury stored.
  - Timing of storage
    - Affects net present value (NPV) of costs.
- Total costs are estimated for two different scenarios:
  1. 7.5K metric tons – 40 years of storage projected from 2007
  2. 10K metric tons – 40 years of storage projected from 2007

Notes: All costs are adjusted to 2006 dollars. Net present value calculations use a 7% real discount rate, which reflects the opportunity cost of capital and does not require that annual costs be adjusted for inflation, as specified by OMB Circular A-94. Total cost estimates are conservative, because we assume that storage facilities are built or rented in year 1 with sufficient space for 40 years of storage, even though mercury is added annually.

Total and Per-Pound Costs: 7,500 Tons

2007-2046

SUMMARY TABLE: 7,500 TONS STORED, 2007-2046	PRIVATE STORAGE - RENT		PRIVATE STORAGE - BUILD	
	Minimum	Maximum	Minimum	Maximum
Total Project Costs (undiscounted)	$58,300,000	$147,000,000	$47,000,000	$136,400,000
Net Present Value	$20,200,000	$65,600,000	$17,600,000	$65,500,000
NPV per pound	$1.22	$3.97	$1.07	$3.96
Annualized Costs per pound	$0.092	$0.300	$0.080	$0.297

- The range of costs within each scenario is determined principally by the different closure cost estimates and how they affect costs of financial assurance.
- These costs cannot be compared directly to estimates of annual per-pound storage costs presented by Department of Defense for the operation at Hawthorne, NV, because DOD's costs do not include fixed and capital costs.
- Total per-pound cost estimates do not incorporate any rate of return that a private storer might require.

Notes: Each scenario starts in 2007 and ends in 2046, but storage of Mercury does not begin until 2011. At that point, approximately 450,000 pounds of mercury are stored every year. CAP and RCRA B permits are acquired every ten years, and financial assurance trust fund payments are made for the first ten years of storage. In 2046 (year 40 of the analysis), mercury containers are examined, disposed of, and replaced. Minimum cost estimates assume that the storage facility is located at Oak Ridge, while maximum cost estimates assume that the facility is located at Hawthorne.

Total and Per-Pound Costs: 10,000 Tons

2007-2046

SUMMARY TABLE: 10,000 TONS STORED, 2007-2046	PRIVATE STORAGE - RENT		PRIVATE STORAGE - BUILD	
	Minimum	Maximum	Minimum	Maximum
Total Project Costs (undiscounted)	$70,100,000	$189,200,000	$54,500,000	$174,600,000
Net Present Value	$24,100,000	$85,600,000	$20,300,000	$84,900,000
NPV per pound	$1.09	$3.88	$0.92	$3.85
Annualized Costs per pound	$0.082	$0.291	$0.069	$0.289

- Per pound costs in this scenario are slightly lower than in the previous scenario, because fixed costs are distributed among a greater quantity of mercury.
- The range of costs between the rent and build scenarios is determined mostly by the different closure scenarios and how they affect costs of financial assurance.
- These costs cannot be compared directly to estimates of annual per-pound storage costs presented by Department of Defense for the operation at Hawthorne, NV, because DOD's costs do not include fixed and capital costs.
- Total per-pound cost estimates do not incorporate any rate of return that a private storer might require.

Notes: Each scenario starts in 2007 and ends in 2046, but storage of Mercury does not begin until 2011. At that point, approximately 600,000 pounds of mercury are stored every year. CAP and RCRA B permits are acquired every ten years, and financial assurance trust fund payments are made for the first ten years of storage. In 2046 (year 40 of the analysis), mercury containers are examined, disposed of, and replaced. Minimum cost estimates assume that the storage facility is located at Oak Ridge, while maximum cost estimates assume that the facility is located at Hawthorne.